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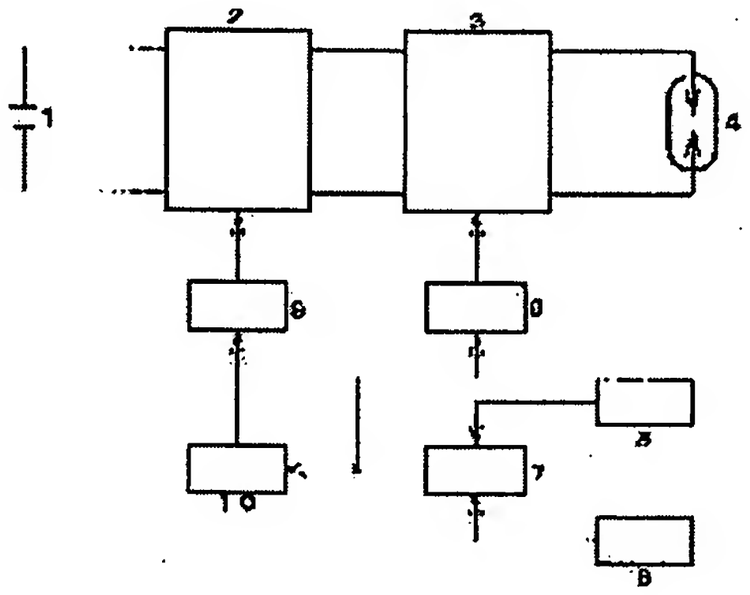
(71)Applicant : IWASAKI ELECTRIC CO LTD
(72)Inventor : KIKUCHI SEIJI
KOKUBO TETSUO

(54) LIGHTING DEVICE FOR HIGH PRESSURE DISCHARGE LAMP

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a lighting device for high-pressure discharge lamps, which keeps the screen illuminance constant, and suppresses a large change in the light intensity and the flickering on the screen by controlling the amount of light entering a light receiving part due to arc spot movement in high-pressure discharge tubes such as ultrahigh pressure mercury lamps.
SOLUTION: In this lighting device for high pressure discharge lamp using a high frequency and low frequency rectangular lamp currents, the high frequency rectangular current of one cycle is applied immediately after a half-cycle of the low frequency rectangular current. The feature of this device is that the high frequency rectangular current is larger than the current of the high- pressure discharge lamp.



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CLAIMS

[Claim(s)]

[Claim 1] It is the high-pressure electric-discharge lamp lighting device which is a high-pressure electric-discharge lamp lighting device which impresses one cycle of RF rectangular current immediately after the half period of low frequency rectangular current in the high-pressure electric-discharge lamp lighting device which makes said high-pressure electric-discharge lamp turn on the lamp current of a high-pressure electric-discharge lamp using low frequency rectangular current and RF rectangular current, and is characterized by this RF rectangular current being the current value of a fault input [current / of said high-pressure electric-discharge lamp / lamp].

[Claim 2] The high-pressure electric-discharge lamp lighting device characterized by impressing RF rectangular current only to the half cycle in the second half of 1 cycle in a high-pressure electric-discharge lamp lighting device according to claim 1.

[Claim 3] A high-pressure electric-discharge lamp lighting device given in claim 1 characterized by using the frequency of said RF rectangular current, choosing the frequency of said low frequency rectangular current from the range of 60-500Hz, and choosing in the range to five to 25 times of the frequency of said selected low frequency rectangular current thru/or which term of 2.

[Claim 4] It is a high-pressure electric-discharge lamp lighting device given in claim 1 characterized by making into 1.2 to 5 times of the lamp current value at the time of normal actuation of a high-pressure electric-discharge lamp the RF rectangular current which is the current value of a fault input rather than the lamp current of said high-pressure electric-discharge lamp thru/or which term of 3.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to amelioration of the high-pressure

electric-discharge lamp lighting device by square wave lighting.

[0002]

[Description of the Prior Art] In recent years, the high-pressure electric-discharge lamp lighting device which combined the pressure-lowering chopper circuit and the full bridge circuit which switches the lighting polarity of a high-pressure electric-discharge lamp by low frequency is used for the light equipment for back lights, such as a liquid crystal projector, etc.

[0003] What was equipped with the circuit shown in drawing 10 as such a high-pressure electric-discharge lamp lighting device is known. By impressing a power source 101 (what carried out rectification smooth [of a direct current or the alternating current]) to the chopper circuit 106 which consists of diode 102, a choke coil 103, a capacitor 104, and a switching element 105, and controlling the duty ratio of a switching element 105 in the PWM control circuit 107, the high-pressure electric-discharge lamp lighting device shown in drawing 10 is changed into suitable direct current voltage to the full bridge circuit 108, and supplies power.

[0004] If fixed time amount from lighting starting and transistors 1011 and 1012 will maintain switch-on and the high-pressure electric-discharge lamp 1010 will be in a lighting stable state, the full bridge circuit 108 will control the high-pressure electric-discharge lamp 1010 put into operation by the ignitor circuit 109 so that transistors 1011 and 1012 and transistors 1013 and 1014 flow by turns. And it is controlled by the full bridge control circuit 1015, and the high-pressure electric-discharge lamp 1010 lights up by the low frequency square wave so that it may operate by low frequency.

[0005]

[Problem(s) to be Solved by the Invention] An ultrahigh pressure mercury lamp is beginning to be used as the back light light sources, such as a liquid crystal projector, in recent years. Moreover, the miniaturization of the reflecting mirror of the light source and high illuminance-ization are progressing further with the miniaturization of a liquid crystal projector, and lightweight-izing. Thereby, the miniaturization of the liquid crystal device which is a part for a light sensing portion is also advanced further.

[0006] In the high-pressure electric-discharge lamp lighting device turned on by the conventional low frequency square wave, since the arc migration in an ultrahigh pressure mercury lamp is uncontrollable, the amount of the light which goes into a part for a light sensing portion by arc migration changes a lot, and in the case of a liquid crystal projector etc., since screen illuminance change becomes large, CHIRATSUKI will occur on a screen. This invention is made based on the above-mentioned situation, and it aims at offering the high-pressure electric-discharge lamp lighting device which controls especially arc migration of an ultrahigh pressure mercury lamp.

[0007]

[Means for Solving the Problem] In order to solve the above-mentioned trouble, invention according to claim 1 In the high-pressure electric-discharge lamp lighting device which makes said high-pressure electric-discharge lamp turn on the lamp current of a high-pressure electric-discharge lamp using low frequency rectangular current and RF rectangular current It is the high-pressure electric-discharge lamp lighting device which impresses one cycle of RF rectangular current immediately after the half period of low frequency rectangular current. This RF rectangular current It is what is characterized by being the current value of a fault input rather than the lamp current of said high-pressure electric-discharge lamp. Invention according to claim 2 In a high-pressure electric-discharge lamp lighting device according to claim 1, it is the high-pressure electric-discharge lamp lighting device characterized by impressing RF rectangular current only to the half cycle in the second half of 1 cycle.

[0008] And invention according to claim 3 chooses the frequency of said low frequency rectangular current from the range of 60-500Hz. It is a high-pressure electric-discharge lamp lighting device given in claim 1 characterized by using the frequency of said RF rectangular current, choosing in the range to five to 25 times of the frequency of said selected low frequency rectangular current thru/or which term of 2. The RF rectangular current whose invention according to claim 4 is the current value of a fault input [current / of said high-pressure electric-discharge lamp / lamp] is a high-pressure electric-discharge lamp lighting device given in claim 1 characterized by carrying out by 1.2 to 5 times the lamp current value at the time of normal actuation of a high-pressure electric-discharge lamp thru/or which term of 3.

[0009] According to invention according to claim 1, arc migration of high-pressure electric-discharge lamps, such as an ultrahigh pressure mercury lamp, can be controlled, screen illuminance change can be decreased, and CHIRATSUKI on a screen can be prevented. Moreover, according to invention according to claim 2, arc migration of high-pressure electric-discharge lamps, such as an ultrahigh pressure mercury lamp, can be mitigated further, and CHIRATSUKI on a screen can be prevented further. According to invention and invention according to claim 4 according to claim 3, according to the lamp power of high-pressure electric-discharge lamps, such as an ultrahigh pressure mercury lamp, CHIRATSUKI on a screen can be prevented very good.

[0010]

[Embodiment of the Invention] The example of this invention is explained with reference to a drawing below. Drawing 1 is the circuit block diagram showing an example of this invention, and consists of a power source 1 (what carried out rectification smooth [of a direct current or the alternating current]), a chopper circuit 2, the full bridge circuit 3, the high-pressure electric-discharge lamp 4, the high frequency square wave oscillator circuit 5, the low frequency square wave oscillator circuit 6, the wave composition circuit 7, a full bridge

control circuit 8, an PWM control circuit 9, and a fault input signal extract circuit 10.

[0011] Drawing 2 is the RF square wave signal waveform diagram of the RF square wave oscillator circuit 5, and drawing 3 is the low frequency square wave signal waveform diagram of the low frequency square wave oscillator circuit 6. The frequency of the RF square wave in drawing 2 is oscillated in the 5 to 25 times as much range as the frequency of the low frequency square wave in drawing 3 .

[0012] Drawing 4 is the output signal wave form chart of the wave composition circuit 7, and is a wave form chart which impresses one cycle of RF square wave signals of drawing 2 immediately after the half period of the low frequency square wave signal of drawing 3 . And if the output signal of the wave composition circuit 7 is inputted into the full bridge control circuit 8, the high-pressure electric-discharge lamp 4 will light up by the wave equivalent to the output signal waveform diagram of the wave composition circuit 7 of drawing 4 .

[0013] Drawing 5 is the detail drawing of the PWM control circuit 9, the resistance of 11a, 11b, and 11c by which parallel connection was carried out to the high-pressure electric-discharge lamp 4 detects lamp voltage, and the resistance 12 for current detection by which series connection was carried out to the high-pressure electric-discharge lamp 4 detects a lamp current. The aforementioned lamp voltage value and aforementioned lamp current value which were detected are inputted into a multiplier 13, and the result of an operation is inputted into the error amplifier 14.

[0014] And in order to adjust the duty ratio of a chopper circuit 2 based on said result of an operation, the PWM control circuit 9 connects Resistance 11d and 11e to the variable resistor 15 and serial which were connected to the input terminal of the error amplifier 14, and connects a switching device 16 to 11d of these resistance, and 11e and juxtaposition. After controlling the duty ratio of a chopper circuit 2 in the PWM control circuit 9, it changes into suitable direct current voltage to the full bridge control circuit 8, and power is supplied to the high-pressure electric-discharge lamp 4. [0015] And by the fault input signal extract circuit 10, if the time amount of 1 cycle of a RF square wave part is taken out from the signal wave form of the wave composition circuit 7 of drawing 4 as a signal, it will become a signal waveform diagram like drawing 6 . If the signal wave form of drawing 6 is given to a switching device 16, a switching device 16 will flow, the both ends of 11d of resistance will short-circuit it, the electrical potential difference built over resistance 11e rather than the time of normal actuation will rise, and duty ratio will become large. Only when duty ratio becomes large, and the switching device 16 has flowed [the lamp current supplied to the high-pressure electric-discharge lamp 4], a lamp current becomes large and becomes a lamp current wave form Fig. like drawing 7 . Drawing 7 is the lamp current wave form of one example of this invention.

[0016] Moreover, by the fault input signal extract circuit 10, if the time amount of the half cycle in the second half of 1 cycle of a RF square wave part is taken out from the signal wave

form of the wave composition circuit 7 of drawing 4 as a signal, it will become a signal waveform diagram like drawing 8 . If the signal wave form of drawing 8 is given to a switching device 16, it will become a lamp current wave form Fig. like drawing 9 . Drawing 9 is the lamp current wave form of other examples of this invention.

[0017] Like drawing 7 or drawing 9 , since it is influenced by the temperature of an electrode, since the discharge section of an electrode can warm CHIRATSUKI generated at the time of the change of a current wave form by switching on the light with the current value of a fault input rather than a lamp current, migration of an arc spot can be controlled, arc migration can decrease, screen illuminance change can decrease, and it can prevent CHIRATSUKI on a screen at the time of the change to low frequency rectangular current from RF rectangular current.

[0018] The lamp whose lamp power is 120W using the high-pressure electric-discharge lamp lighting device of this invention The frequency of 90Hz and RF rectangular current 1kHz, [the frequency of low frequency rectangular current] The aging trial made to turn on with the current value of an about 2-time fault input rather than the lamp current value at the time of normal actuation is performed. When screen illumination photometry was performed, the screen illuminance change accompanying migration of the arc generated in high-pressure electric-discharge lamps, such as an extra-high voltage mercury electric-discharge lamp, could be decreased, and CHIRATSUKI on a screen has been prevented.

[0019] Moreover, if the frequency of low frequency rectangular current is set to less than 60Hz, CHIRATSUKI will occur on a screen, and if the frequency of low frequency rectangular current is made larger than 500Hz, an acoustical resonance phenomenon will occur. And if a load will be applied to an electrode, an electrode will break, if the frequency of said RF rectangular current is made into less than 5 times of the frequency of said selected low frequency rectangular current, the frequency of said selected low frequency rectangular current is larger than 25 times and the frequency of said RF rectangular current is carried out, it becomes impossible to warm the arc spot section of an electrode, and an arc spot will move. And it is because increasing RF rectangular current 1.2 to 5 times of the lamp current value at the time of normal actuation of a high-pressure electric-discharge lamp has effectiveness in warming the arc spot section of an electrode most and it is hard coming to move an arc spot.

[0020] In addition, by adjusting the electrical potential difference concerning resistance 11e with the resistance of 11d of resistance, considering as the current value of a fault input is more possible than the lamp current value according to the lamp power of the high-pressure electric-discharge lamp 4, and CHIRATSUKI on a screen can be prevented very good according to the lamp power of high-pressure electric-discharge lamps, such as an ultrahigh pressure mercury lamp.

[0021]

[Effect of the Invention] Since according to this invention migration of the arc spot of high-pressure electric-discharge lamps, such as an ultrahigh pressure mercury lamp, can be controlled and arc migration decreases as explained above, screen illuminance change can be decreased and CHIRATSUKI on a screen can be prevented. Furthermore, according to the lamp power of high-pressure electric-discharge lamps, such as an ultrahigh pressure mercury lamp, CHIRATSUKI on a screen can be prevented very good.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] The block circuit diagram showing an example of this invention

[Drawing 2] RF square wave signal waveform diagram

[Drawing 3] Low frequency square wave signal waveform diagram

[Drawing 4] The output signal wave form chart of a wave composition circuit

[Drawing 5] Detail drawing of an PWM control circuit

[Drawing 6] The signal waveform diagram which took out the time amount of 1 cycle of a RF square wave part as a signal

[Drawing 7] The lamp current wave form Fig. of one example of this invention

[Drawing 8] The signal waveform diagram which took out the time amount of the half cycle in the second half of 1 cycle of a RF square wave part

[Drawing 9] The lamp current wave form Fig. of other examples of this invention

[Drawing 10] The conventional high-pressure electric-discharge lamp lighting device

[Description of Notations]

1 Power Source

2 Chopper Circuit

3 Full Bridge Circuit

4 High-Pressure Electric-discharge Lamp

5 RF Square Wave Oscillator Circuit

6 Low Frequency Square Wave Oscillator Circuit

7 Wave Composition Circuit

8 Full Bridge Control Circuit

9 PWM Control Circuit

10 Fault Input Signal Extract Circuit

11a, 11b, 11c, and 11d Resistance

12 Resistance for Current Detection

13 Multiplier

14 Error Amplifier

15 Variable Resistor

16 Switching Device